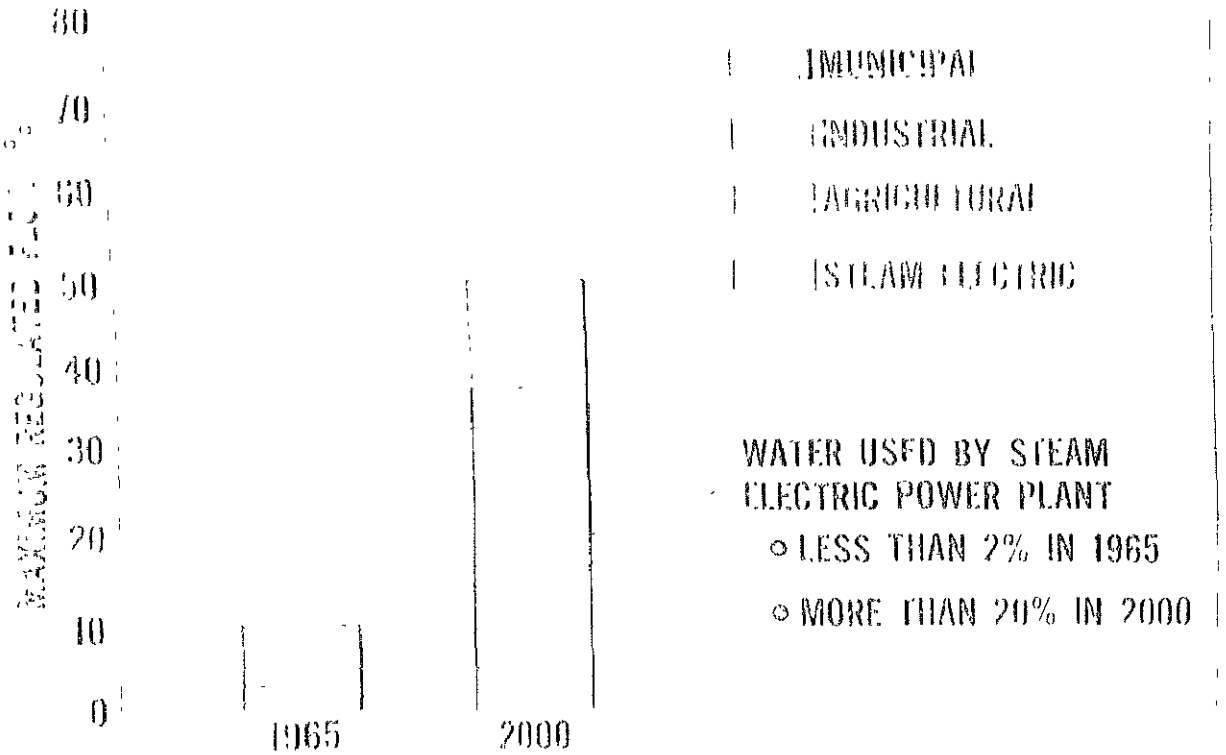
TABLE OF CONTENTS - BY B&R CATEGORY

BT UNT	TITLE	MANAGER	FY-81 FUNDING	PAGE
TS	OTHER			
	NATIONAL WASTE TERMINAL STORAGE PROGRAM AND SPENT FUEL ENGINEERING	RJ CASH	$ 924K	28
	FUSION REACTOR SAFETY SUPPORT STUDIES	TD MUELLER-STEIN	441	30
		SUBTOTAL	$1365K	
		TOTAL	$7262K	

TABLE OF CONTENTS - BY ORGANIZATION

WATER RESOURCE EVALUATIONS



WATER USED BY STEAM ELECTRIC POWER PLANT

- LESS THAN 2% IN 1965
- MORE THAN 20% IN 2000

WATER USE INFORMATION SYSTEM

- INDIVIDUAL POWER PLANT CHARACTERISTICS
- REGIONAL HYDRAULIC DATA
- WATER RIGHTS
- REGIONAL LOAD FORECASTS
- REGIONAL WATER USAGE

ER USE INFORMATION SYSTEM

HEDL
Cost Account - AKB
Oper. X **Inv.**

ger: J F. Fletcher
Department: Technology

: $ 100K

Customer:
Organization: DOE/ANSP
Contact: W F. Savage
Program: Advanced Technology and Systems Assessment
AE-05-05

ECTIVE

ide data and evaluations on water resource availability in support of the advanced systems program

PE

elop and operate the computerized Water Use Information System. Perform national gional water resource evaluations at DOE request

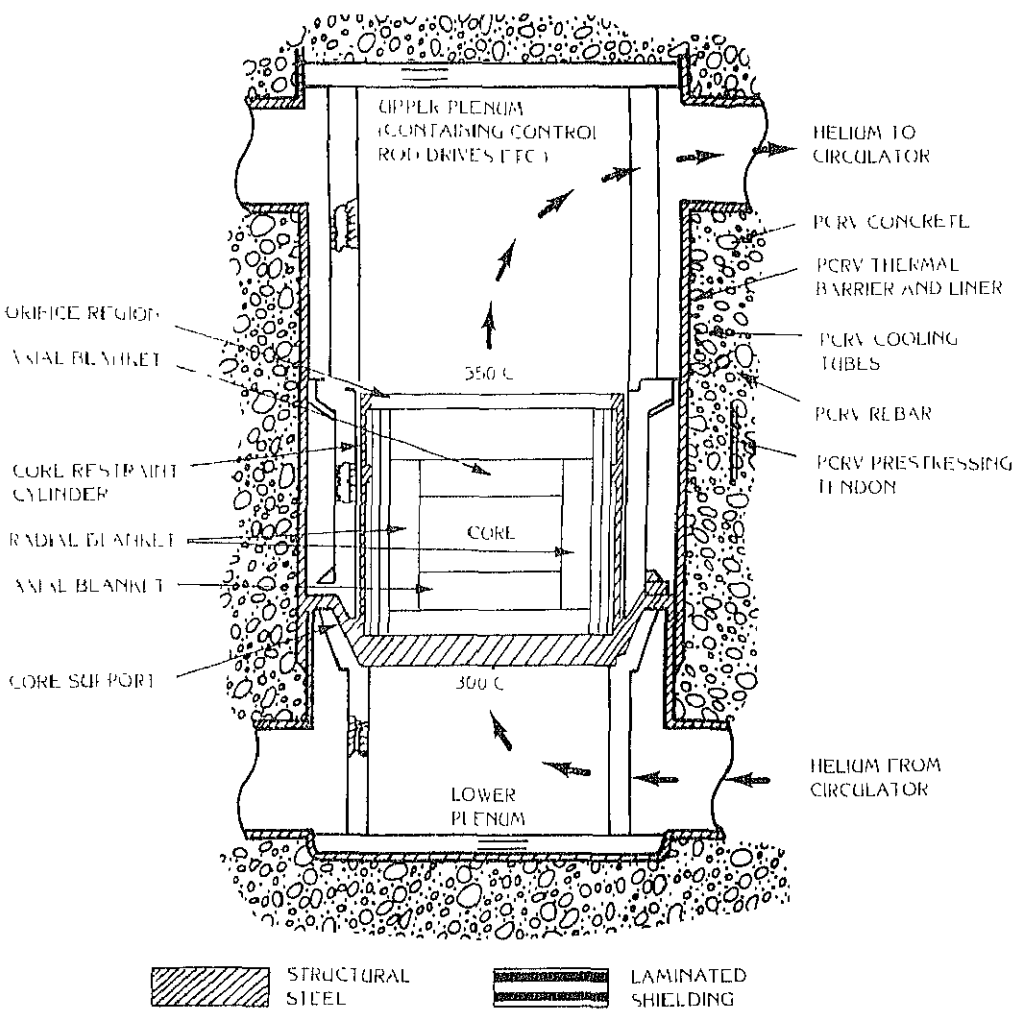
NT TECHNICAL HIGHLIGHTS

, an econometric predictive model for electricity demand, was completed and used in l water resource evaluations.
rsory water resources evaluation of national and regional water availability for power oling was completed.

CTED NEAR-TERM ACCOMPLISHMENTS

pdated, detailed study of national and regional water availability for power plant cool- be completed.

CROSS SECTION OF GCFR DEMONSTRATION PLANT REACTOR CAVITY



GAS COOLED FAST REACTOR STRUCTURAL MATERIALS

HEDL
Cost Account - AKS
Oper. X **Inv.** _____

Manager: L D. Blackburn
Sub-Department: Technology

FY-81: $ 20K

Customer:
Organization: DOE/RRT
Contact: G.A. Newby
Program: Gas Cooled Fast Breeder Reactor Development AF-10-25

OBJECTIVE

Provide mechanical property data on irradiated and unirradiated materials to support the design, safety analyses, and operation of GCFR out-of-core components.

SCOPE

Conduct irradiations and testing to determine strength, ductility, fatigue crack propagation and fracture toughness of selected materials.

RECENT TECHNICAL HIGHLIGHTS

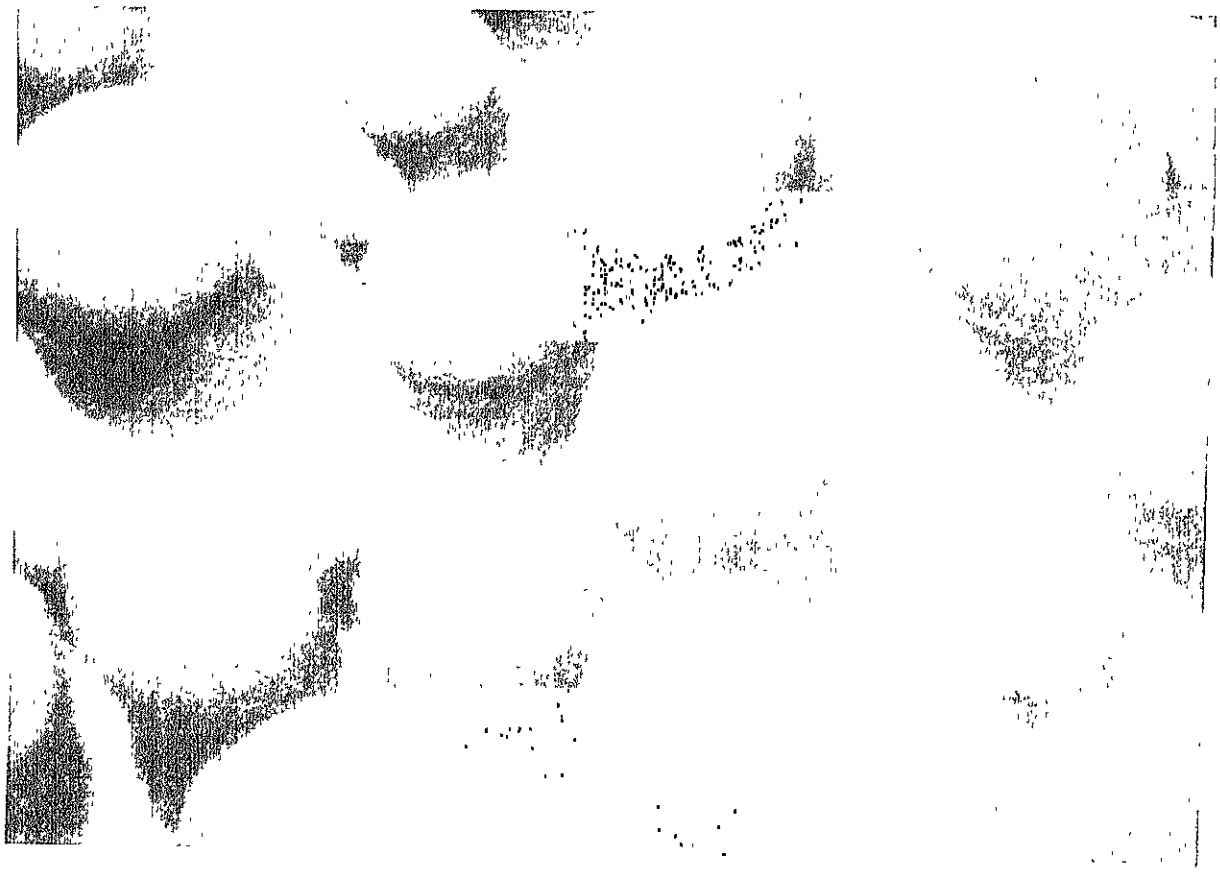
EBR-II irradiation of three pins and postirradiation tension testing to determine high temperature fluence limits for 316 SS materials was completed.

Characterization of fatigue crack propagation in two ferritic steels, modified 9Cr-1Mo and HT-9, was completed.

EXPECTED NEAR-TERM ACCOMPLISHMENTS

GCFR Program is closing out. Documentation of tests and evaluation will be completed in FY-81.

GEL SPHERES



UNSINTERED ~40X

HEDL
Cost Account - ALA
Oper._____ **Inv.**_____

HYBRID FUEL FABRICATION

Manager: D.W. Bennett
Sub-Department: Reactor Core Supply

FY-81: $ 750K

Customer:
Organization: DOE/NPD
Contact: W.W. Ballard
Program: LWR Fuel Cycle
AG-40-10-05

OBJECTIVE

Evaluate the equipment required for fabrication of breeder reactor pellet fuels from an alternate conversion source.

SCOPE

Adapt equipment used to fabricate fuel pellets from mixed oxide powder to make fuel from gel-spheres produced by the internal gelation method.

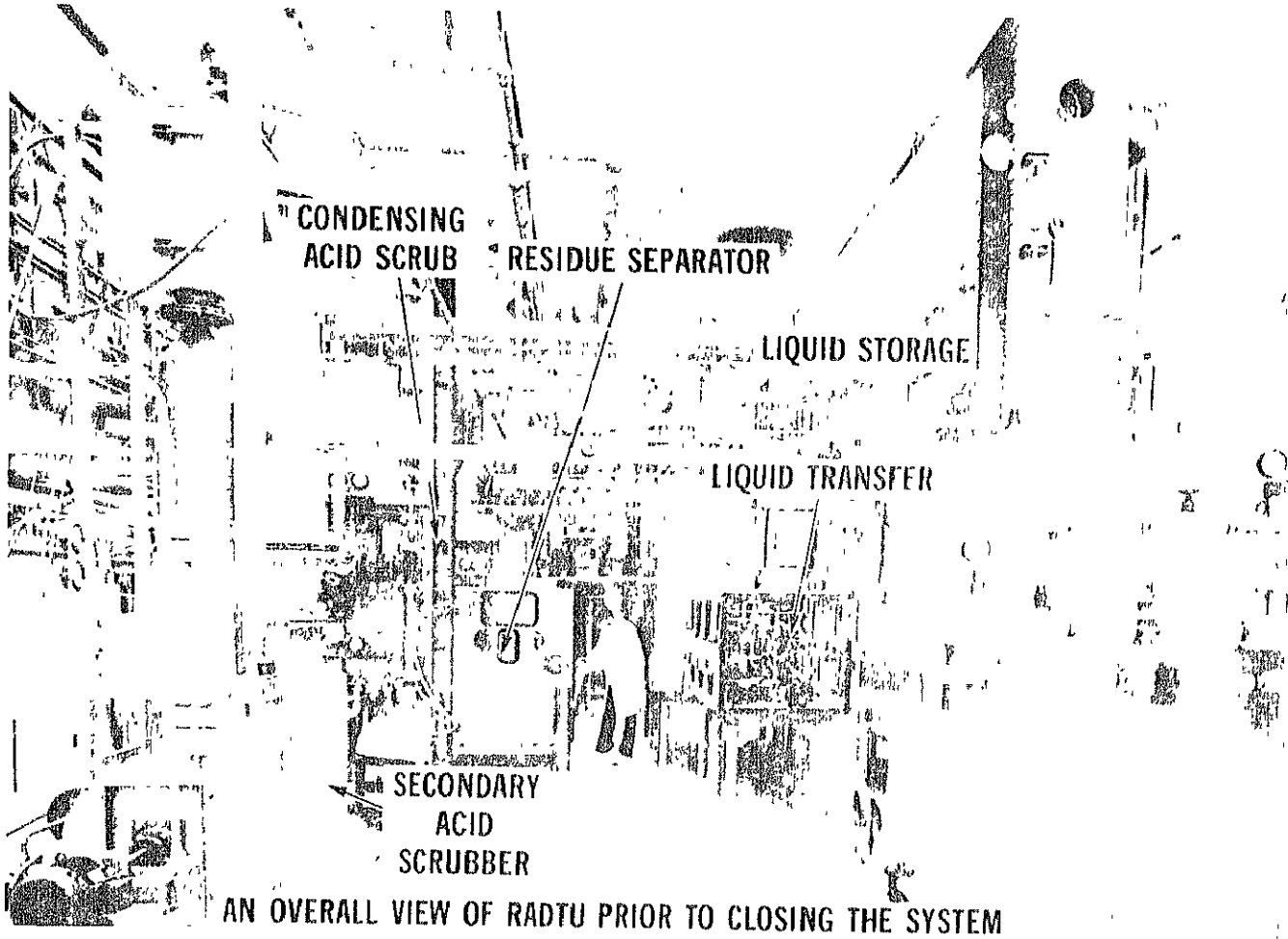
Adapt as necessary automated analytical chemistry techniques, waste/scrap processes, and handling systems to accommodate gel/sphere processing.

RECENT TECHNICAL HIGHLIGHTS

The first sample of gel-spheres was received and is being evaluated and analyzed.
Press feeding system was designed and fabricated.

EXPECTED NEAR-TERM ACCOMPLISHMENTS

Transporting and feeding tests will be conducted with spheres.
Press feed system will be demonstrated.
Cost comparison data will be established.



AN OVERALL VIEW OF RADTU PRIOR TO CLOSING THE SYSTEM

ACID DIGESTION
(LOW LEVEL)

HEDL
Cost Account - AKC
Oper. X **Inv.**

Manager: C R Allen
Sub-Department: Technology

FY-81: $ 1500K

Customer:
Organization: DOE/RL
Contact: G Miskho/W C. Johnson
Program: Defense Waste Management
AR-05-10-02-F

OBJECTIVE

Process Z-plant transuranic waste and scrap Demonstrate capability of acid digestion system to process various waste and scrap forms.

SCOPE

Demonstrate capability of the Radioactive Acid Digestion Test Unit (RADTU) to process Z-plant waste, D&D waste, and special waste forms.

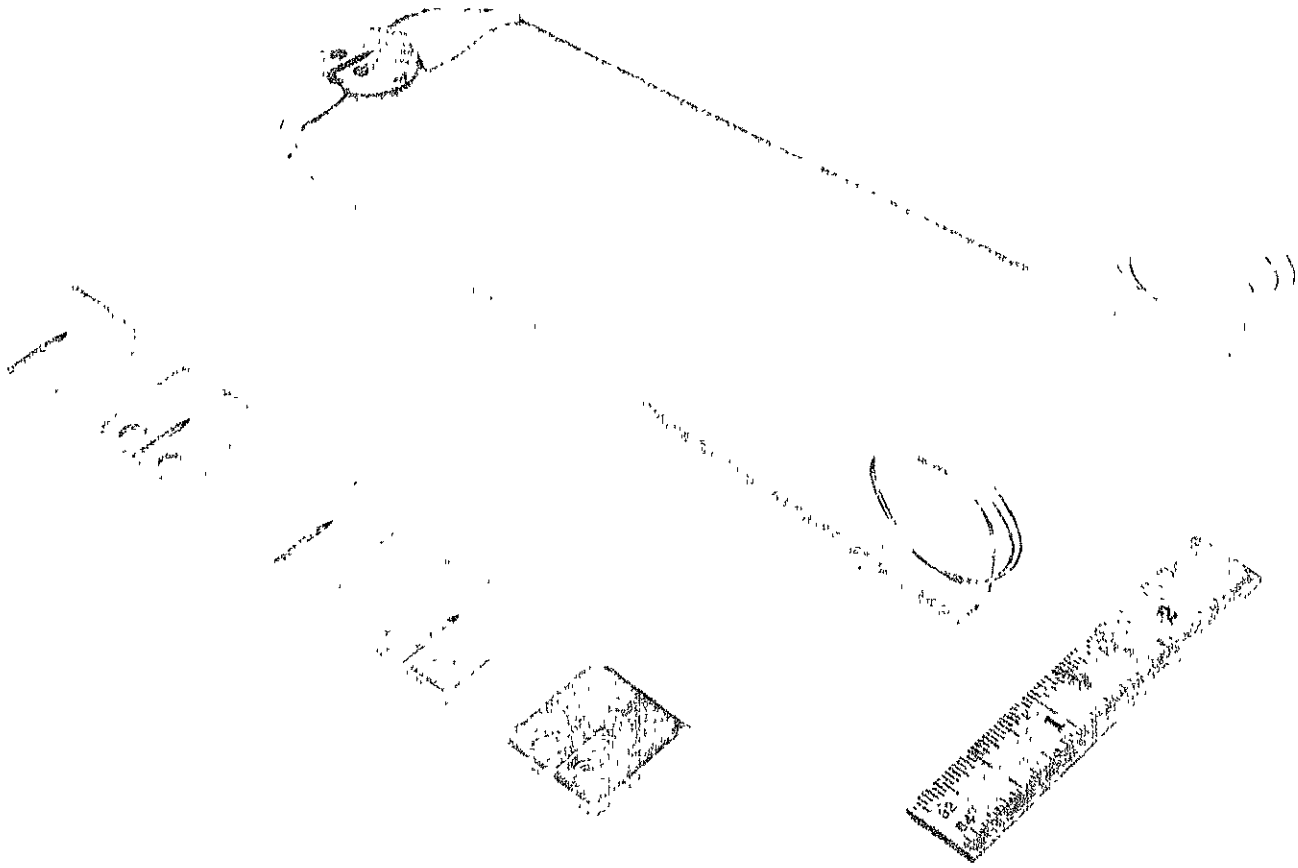
RECENT TECHNICAL HIGHLIGHTS

High rate digester equipment was installed and tested to increase system capacity to 10 kg waste/hr. Centrifuge and air classification equipment was installed and tested. Radioactive operation was restarted in June, 1980.

International workshop on acid digestion was held at HEDL in October, 1980.

EXPECTED NEAR-TERM ACCOMPLISHMENTS

Demonstration of high activity waste processing will be completed in CY 1980. Tests in RADTU to determine processability of "unique solutions" and reactive scrap forms will be completed in FY-81.



MAGNETIC FUSION ENERGY-5 (MFE-5) IN
REACTOR FATIGUE CRACK GROWTH EXPERIMENT

FUSION ALLOY DEVELOPMENT

HEDL
Cost Account - AKH
Oper. X **Inv.**

Manager: G.L. Wire
Sub-Department: Technology

FY-81: $ 750K

Customer:
Organization: DOE/OFE
Contact: T.C. Reuther
Program: Fusion Reactor Materials
AT-15 30 31

OBJECTIVE

Develop, characterize and qualify materials for fusion reactor wall applications.

SCOPE

Test and analyze irradiated materials to determine fatigue, fracture toughness, swelling, and creep.

RECENT TECHNICAL HIGHLIGHTS

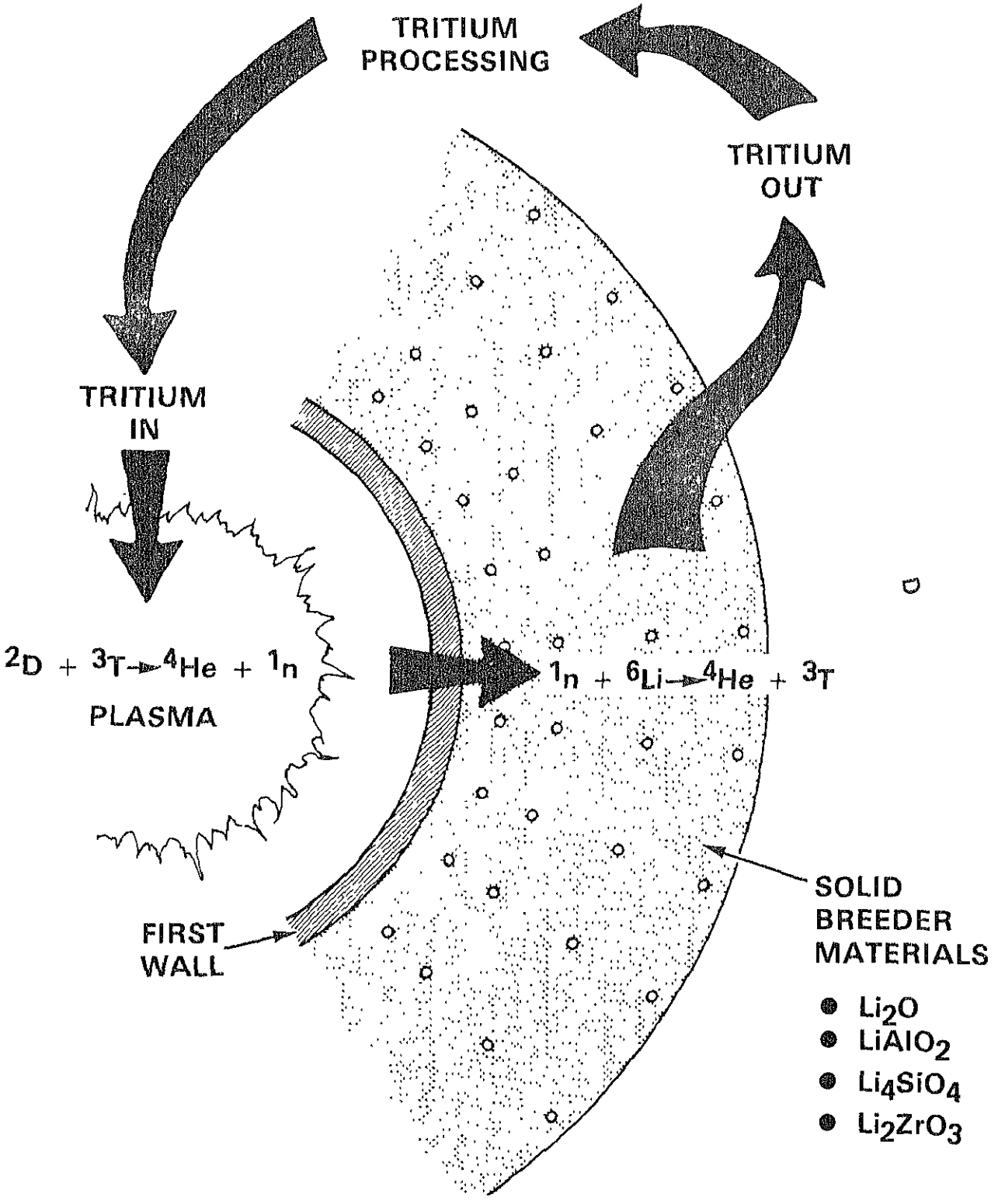
Fabrication of the world's first MFE-5 in-reactor fatigue and crack growth experiment was completed and the test assembly is ready for insertion into the Oak Ridge Research Reactor.

EXPECTED NEAR-TERM ACCOMPLISHMENTS

Irradiation of the MFE-5 experiment in the Oak Ridge Research Reactor will be started. Post irradiation fatigue crack growth tests on titanium will be started.

SOLID BREEDER MATERIALS IN FUSION REACTORS

- A BASIC ELEMENT OF THE TRITIUM CYCLE



SOLID TRITIUM
BREEDER DEVELOPMENT

HEDL
Cost Account - ALT
Oper. X **Inv.** _____

Manager: E.T. Weber
Sub-Department: Core Evaluation

FY-81: $ 200K

Customer:
Organization: DOE/OFE
Contact: T.C. Reuther
Program: Fusion Reactor Materials
AT-15-30-33

OBJECTIVE

Develop, characterize and qualify blanket materials for fusion reactor applications

SCOPE

Fabricate, irradiate and analyze lithium ceramic materials for fusion blanket.

RECENT TECHNICAL HIGHLIGHTS

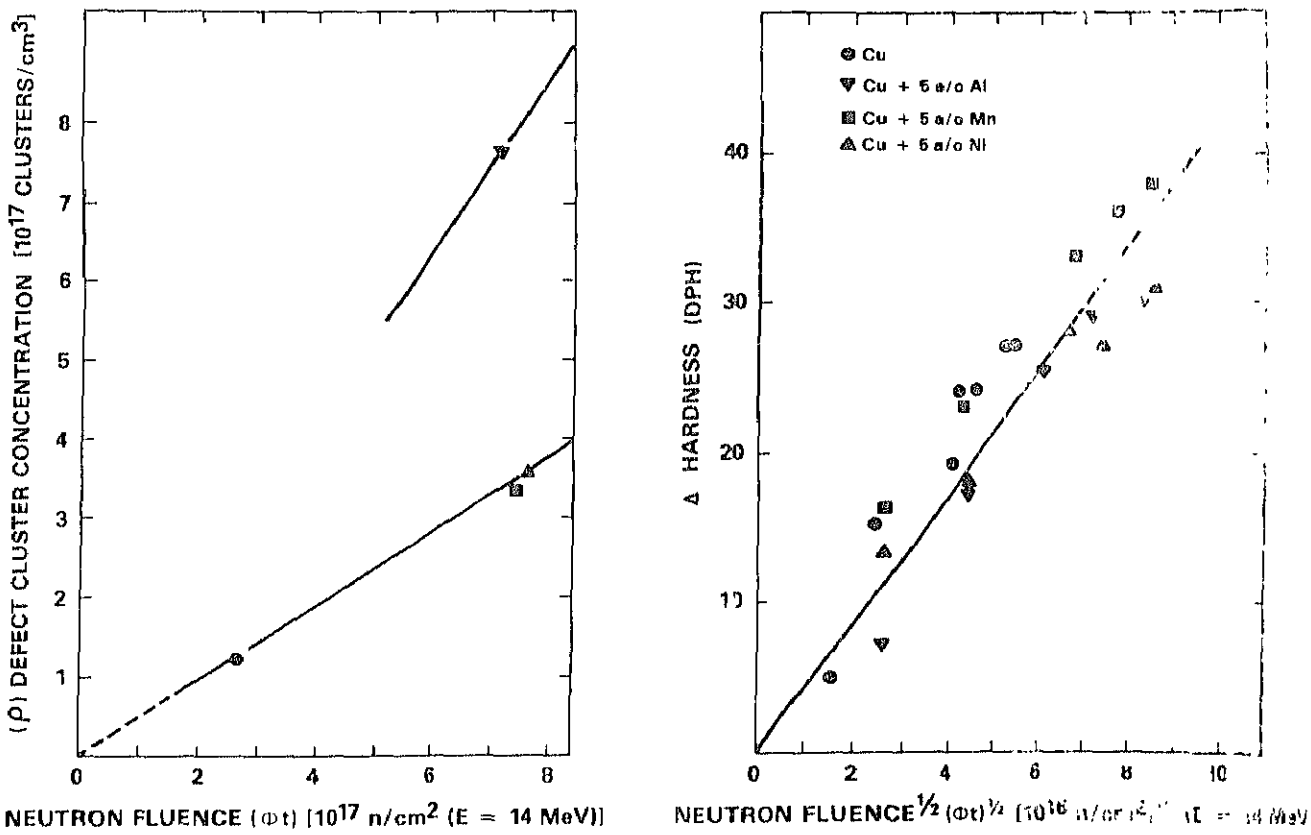
Technical feasibility for a Fusion Breeder Materials Irradiation experiment in EBR-II was been established.

EXPECTED NEAR-TERM ACCOMPLISHMENTS

Complete qualification of lithium ceramic materials for irradiation in EBR-II. Complete test design for EBR-II Solid Breeder Materials Test.

ALLOY INDEPENDENT IRRADIATION HARDENING INDICATES THAT ALLOY ADDITIONS INFLUENCE VISIBILITY OF DEFECT CLUSTERS

(14 MeV NEUTRONS; 25°C IRRADIATION TEMP.)



IRRADIATION EFFECTS ANALYSIS

HEDL
Cost Account - AKJ
Oper. X **Inv.** _____

Manager: D.G Doran
Sub-Department: Technology

FY-81: $ 700K

Customer:
Organization: DOE/OFE
Contact: K M. Zwilsky
Program: Fusion Reactor Materials
AT-15-30-34

OBJECTIVE

Clarify fundamental processes controlling material response to irradiation and develop correlations for extrapolation of fission-generated data base to fusion environments.

SCOPE

Analyze basic radiation damage events, model mechanisms of material response, and conduct experimental studies involving comparative fission and fusion irradiations

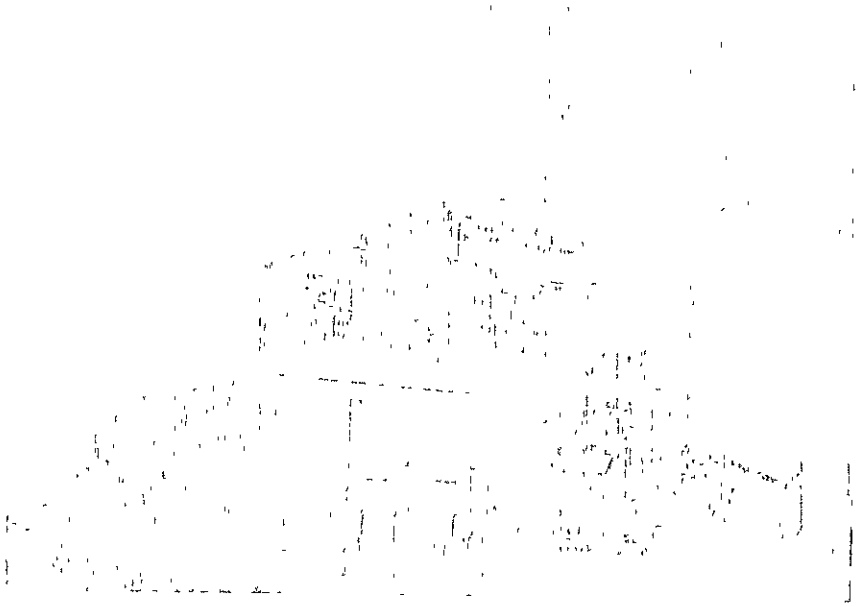
RECENT TECHNICAL HIGHLIGHTS

High resolution electron microscopy and recently developed microhardness measurement techniques were used to analyze the initiation of microstructural damage in specimens irradiated by fusion energy neutrons. A computer graphics capability was developed for analyzing atomistic damage models.

EXPECTED NEAR-TERM ACCOMPLISHMENTS

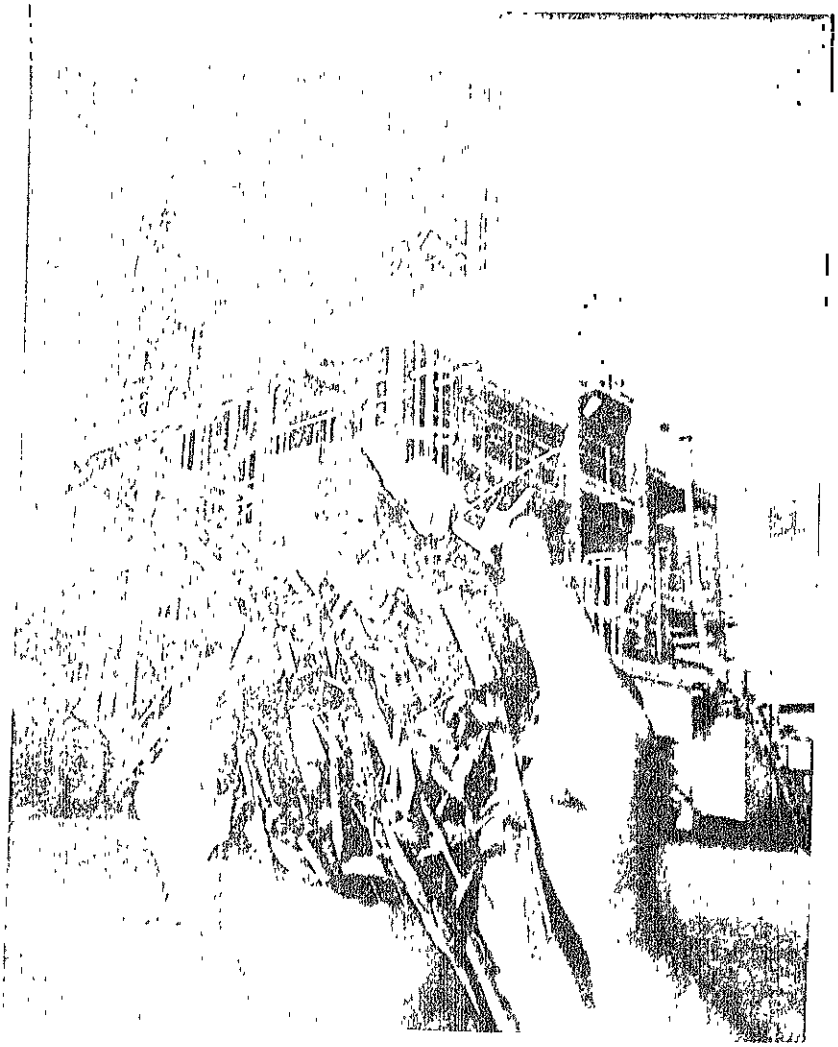
Atomistic modeling of high energy neutron damage production will be extended to higher energy events (several hundred KeV) and computer graphical analyses made. Electron microscopy will begin on specimens irradiated in Oak Ridge Research Reactor and EBR-II to determine helium effects on microstructure.

COAL MINING



BIOMASS DEVELOPMENT

Evaluation of pollution impact from non-point sources.



HEDL
Cost Account - ALR
Oper. X **Inv.** _____

OTI WATER RESOURCE STUDIES

Manager: J.F. Fletcher
Sub-Department: Technology

FY-81: $ 25K

Customer:
Organization: DOE/DEA/RID
Contact: F H Osterhaudt
Program: Energy Assessment Regional Impacts Program
HA-01-03-04

OBJECTIVE

Provide water resource data and analytical support for Energy Assessment Regional Impact Programs.

SCOPE

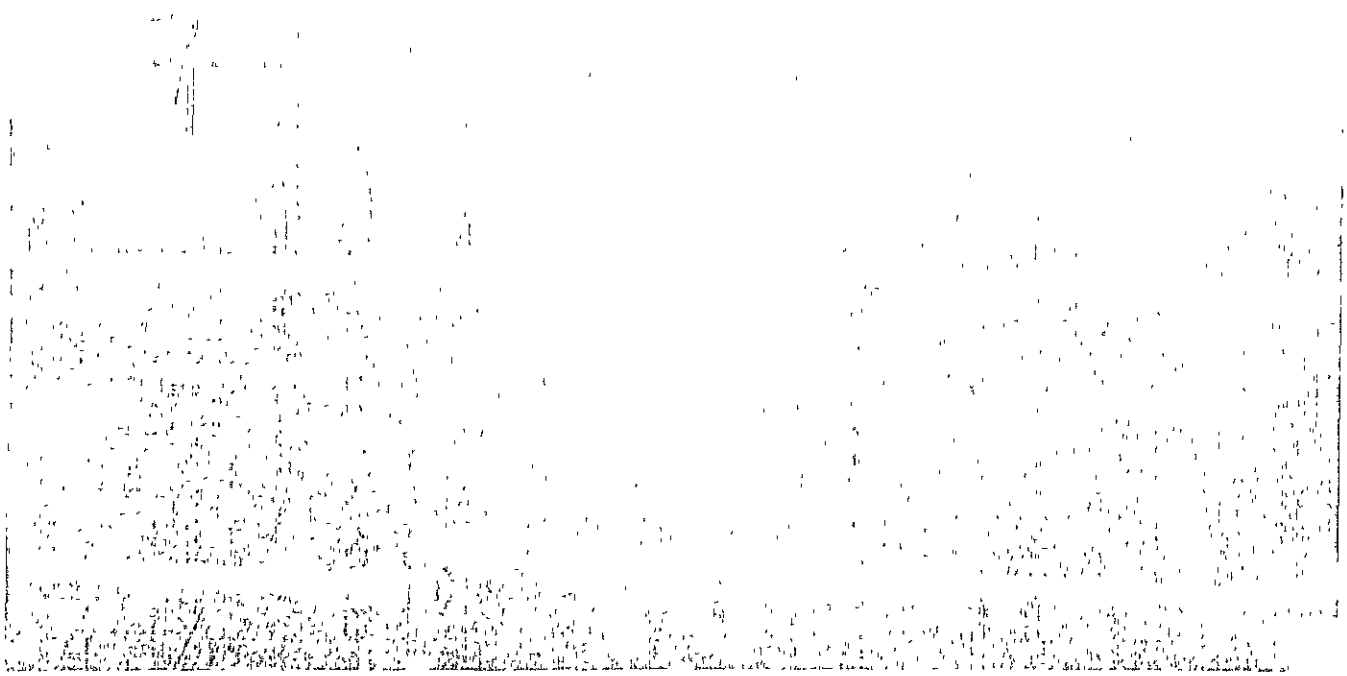
Evaluate the nature and extent of non point pollution impacts expected from energy activities.

RECENT TECHNICAL HIGHLIGHTS

Requested evaluations and water resource data were submitted

EXPECTED NEAR-TERM ACCOMPLISHMENTS

Evaluation of pollution impacts associated with mining, synfuels development and biomass development will be completed.



IRFM FLOW MODEL FOR THERMAL HYDRAULIC TESTING OF REACTOR FLOW SYSTEMS

CRBRP REACTOR SYSTEMS THERMAL HYDRAULIC TESTING

HEDL
Cost Account - EBA
Oper. X **Inv.**

Manager: W.L. Thorne
Sub-Department: Technology

FY-81: $ 890K

Customer:
Organization: CRBRP
Contact:
Program: Special Request

OBJECTIVE

Provide thermal hydraulic, vibration and mechanical testing of CRBRP reactor systems in accordance with Work Agreements L-274, L-294, and L-295

SCOPE

CRBRP Reactor Systems Testing at HEDL involves hydraulic and mechanical design verification test programs of reactor vessel internal systems including full-scale fuel and radial blanket assemblies, one-quarter scale inlet plenum and outlet plenum models, and other reactor vessel components under steady state reactor conditions

RECENT TECHNICAL HIGHLIGHTS

Completed data reduction and analysis of the original CRBRP Integral Reactor Flow Model (IRFM) Bypass Thermal Striping tests.

Performed initial CRBRP Duct Bending/Load Pad Strength testing.

Started flow and vibration testing on full scale prototypic CRBRP radial blanket fuel assembly.

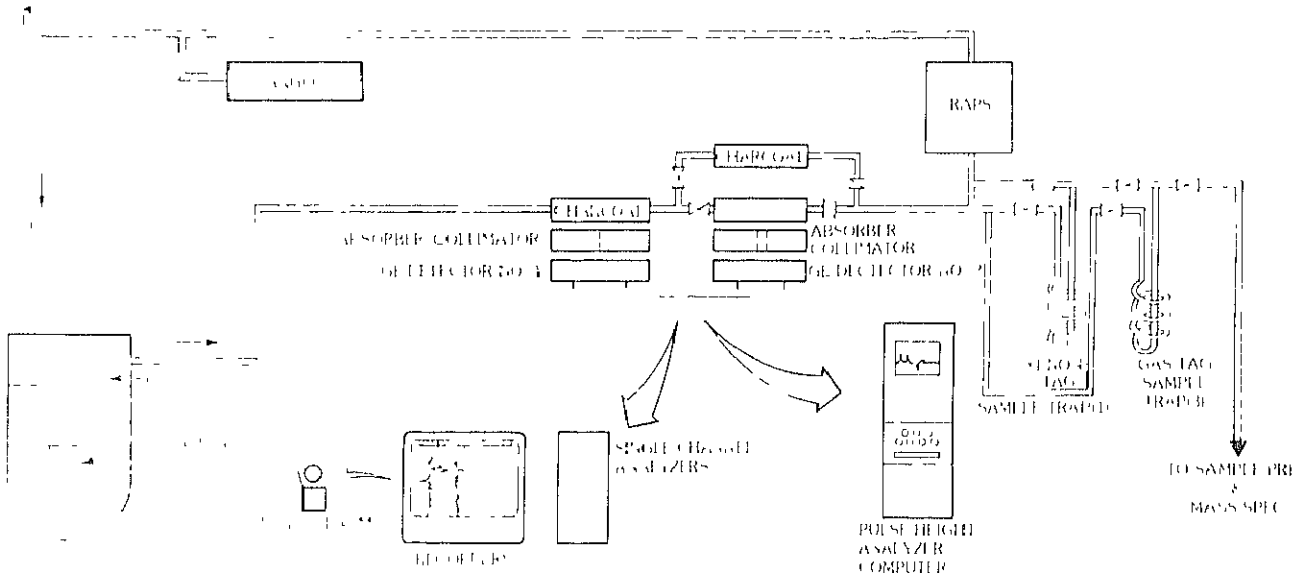
EXPECTED NEAR-TERM ACCOMPLISHMENTS

Perform Phase V of the Fuel Assembly Cavitation and Orifice Calibration tests and issue report.

Perform CRBRP Piston Ring Leakage test program and issue report.

Complete CRBRP Duct Bending/Load Pad Strength test program and issue report

COVER GAS MONITORING FOR CRBRP - PRELIMINARY DESIGN



CRBRP FUEL
FAILURE MONITORING

HEDL
Cost Account - EBC
Oper. X **Inv.**_____

Manager: J.J. McCown
Sub-Department: Technology

FY-81: $ 90K

Customer:
Organization: CRBRP
Contact:
Program: Special Request

OBJECTIVE

Finalize basic parameters of cover gas Fuel Failure Monitoring sampling and analysis subsystem. Provide engineering consultation services during preliminary design.

SCOPE

Modify Prooftest Experiment, EX-154, at EBR-II and test suitability of modifications

Develop computer codes that use mass spectrometric and radiometric analyses to locate and characterize fuel failures.

RECENT TECHNICAL HIGHLIGHTS

Installed HEDL designed thick absorber in position #5 of Detector No. 2's device to improve very high countrate capability.

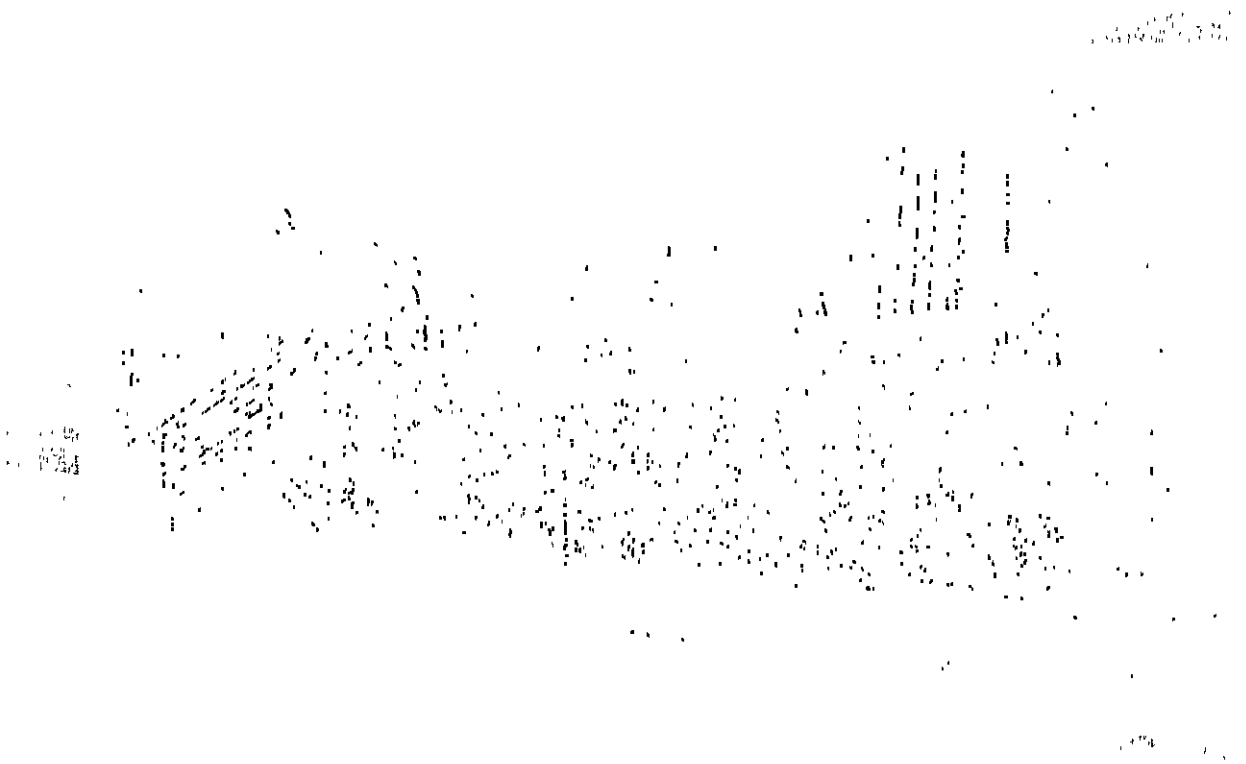
Tested modified Gamma Ray Subtract (GRS) software for use with compound absorber-collimators and with thick absorber.

EXPECTED NEAR-TERM ACCOMPLISHMENTS

Data on suitability of compound absorber-collimators and of thick absorbers will be provided.

The feasibility of using one rather than two sampling and measurement modules will be determined.

Modification and testing of GRS software will be completed.



TRANSPORTATION OF SPENT FUEL IN
LWR SHIPPING CASK

HEDL
Cost Account - EAA
Oper. X **Inv.** _____

SHIPPING CASK ANALYSIS

Manager: J.F Fletcher
Sub-Department: Technology

FY-81: $ 120K

Customer:
Organization: NRC
Contact:
Program: Special Request

OBJECTIVE

Assist in standards development and compliance evaluations for NRC by developing a computer simulation model of the mechanical response of radioactive material shipping packages.

SCOPE

Develop computerized simulation model of mechanical responses of LWR spent fuel shipping casks in normal transport situations. Validate and parametrically extend the model; provide calculated results to apply to standards development.

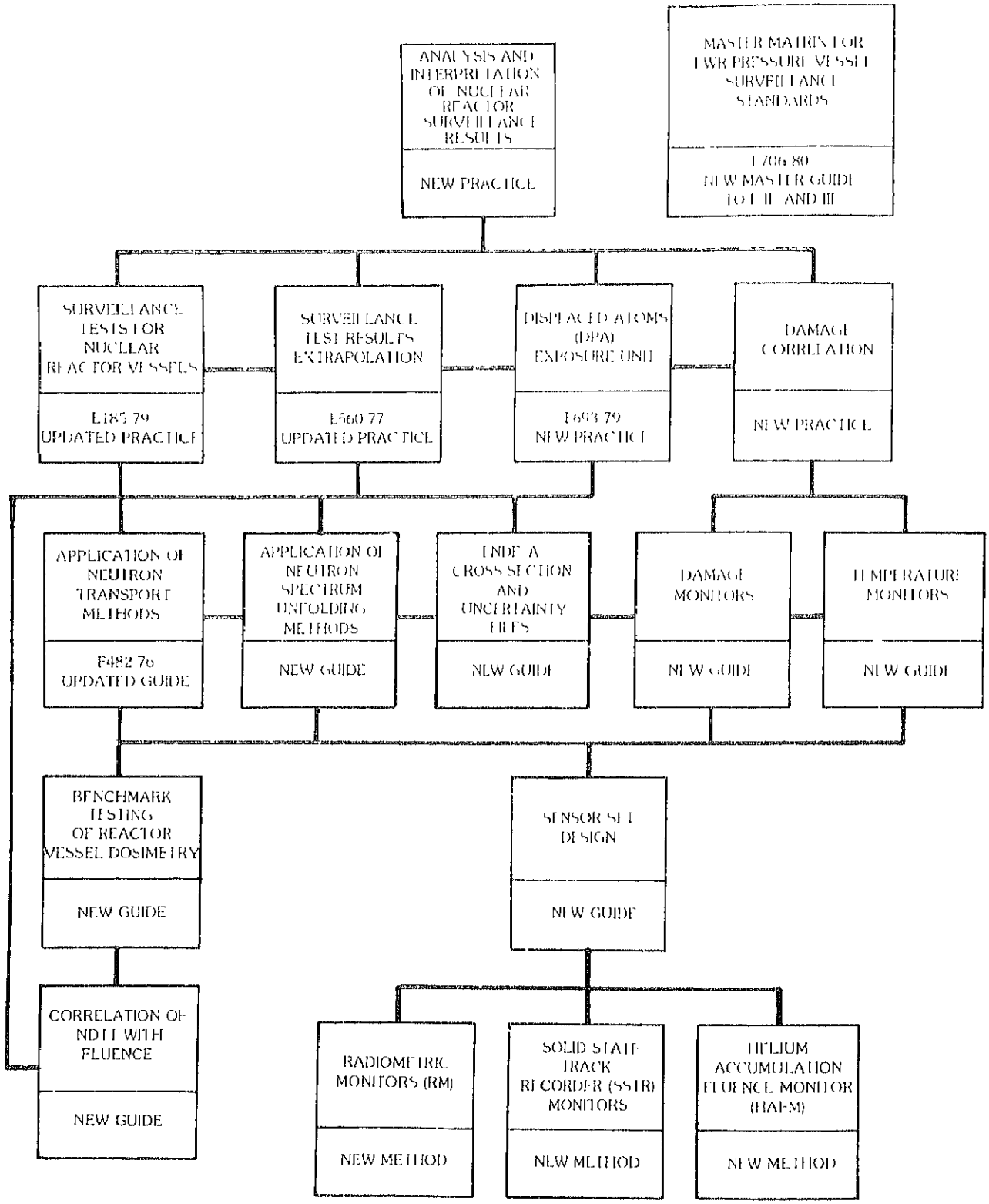
RECENT TECHNICAL HIGHLIGHTS

Preliminary validation of the computerized simulation model was completed. Parametric and sensitivity analysis were completed.

EXPECTED NEAR-TERM ACCOMPLISHMENTS

Complete model validation. Extend parametric and sensitivity analysis and supply data and methodology for purposes of developing regulatory guidelines.

ASTM STANDARDS FOR SURVEILLANCE OF NUCLEAR REACTOR PRESSURE VESSELS



HEDL
Cost Account - EAB
Oper. X **Inv.** _____

LWR NEUTRON DOSIMETRY

Manager: W N McElroy
Sub-Department: Technology

FY-81: $ 588K

Customer:
Organization: NRC
Contact:
Program: Special Request

OBJECTIVE

Establish updated and improved ASTM standards for LWR pressure vessel irradiation surveillance, dosimetry, damage correlation, and associated reactor analysis and interpretation procedures

SCOPE

Prepare and write 17 ASTM recommended standards.

Perform supporting analytical and experimental work: validation and calibration of the recommended ASTM standards using "Standard, Reference, and Controlled Environment Benchmark Neutron Fields," Reactor "Test Regions," and Operating Power Reactor "Surveillance Positions."

RECENT TECHNICAL HIGHLIGHTS

Major physics and dosimetry studies in a low-flux level pressure vessel mockup at ORNL, including a "Blind Test" validation of physics calculations involving US and foreign participants, was completed.

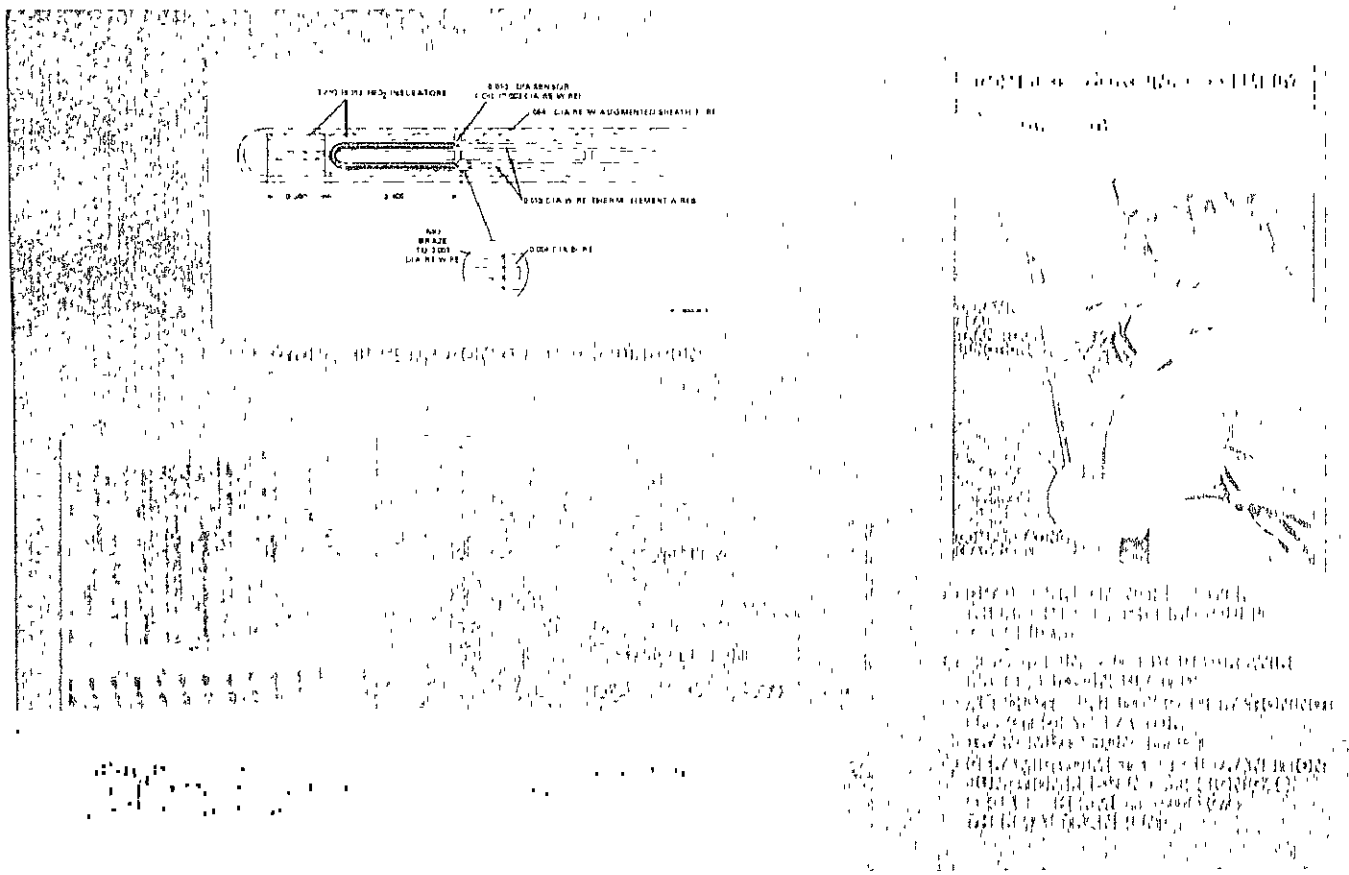
A two-year metallurgical irradiation in a high-flux level pressure vessel mockup at ORNL was started. A shorter irradiation of a mockup surveillance capsule was completed.

EXPECTED NEAR-TERM ACCOMPLISHMENTS

Preparation and writing of key ASTM Practice, IA will be completed.

Analysis of samples from the metallurgical irradiation at ORNL will be started. This will validate the accuracy of using surveillance capsule data to make end-of-life predictions for the pressure vessels of LWR operating power reactors.

LOFT 2200°C FUEL CENTERLINE JOHNSON NOISE POWER THERMOMETER (JNPT)



LOFT ADVANCED FUEL ROD INSTRUMENTATION DEVELOPMENT

HEDL
Cost Account - EAD
Oper. X **Inv.** ____

Manager: E.M. Sheen
Sub-Department: Reactor Core Supply

FY-81: $ 164K

Customer:
Organization: NRC
Contact:
Program: Special Request

OBJECTIVE

Develop fuel rod instrumentation for NRC loss-of-flow tests (LOFT Program)

SCOPE

Develop fuel centerline temperature measurement systems to 2200°C fuel rod gas plenum pressure sensors, axial motion monitoring sensor and fast plenum thermocouples

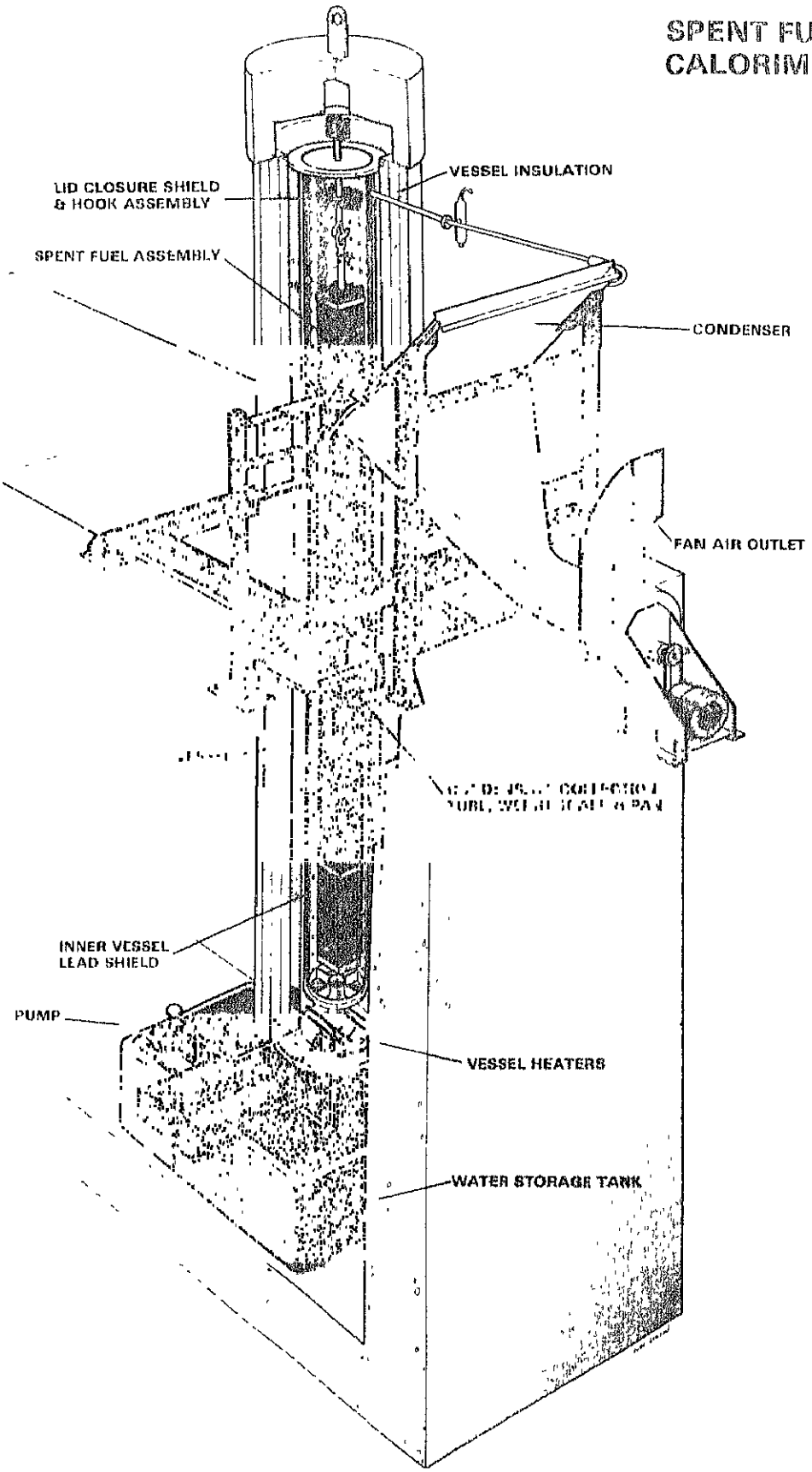
RECENT TECHNICAL HIGHLIGHTS

A fuel centerline temperature measurement system combining a Johnson Noise Power resistance coil and 2200°C thermocouple was tested in the laboratory. Vector signal analysis techniques improved fuel rod plenum pressure accuracy during temperature transients by a factor of 2.

EXPECTED NEAR-TERM ACCOMPLISHMENTS

A combined Johnson Noise Power and thermocouple for fuel centerline temperature measurement will be produced for trial in a test reactor.

SPENT FUEL CALORIMETER



NATIONAL WASTE TERMINAL STORAGE PROGRAM
SPENT FUEL ENGINEERING

HEDL
Cost Account - ECA
Oper. X **Inv.** _____

Manager: R.J Cash
Sub-Department: Technology

FY-81: $ 924K

Customer:
Organization: Office of Nuclear Waste Isolation
Contact:
Program: Special Request

OBJECTIVE

Develop technology to select and characterize Unreprocessed Light Water Reactor spent fuel waste forms suitable for isolation in a mined geologic repository

SCOPE

Develop data bases and theoretical and empirical correlations to characterize and describe the behavior of spent fuel after geologic emplacement in mine repositories Identify, test, select and qualify stabilizer materials for isolating spent fuel rods in geologic waste packages.

RECENT TECHNICAL HIGHLIGHTS

The first known decay heat measurement of a spent fuel assembly was successfully accomplished using a calorimeter designed, fabricated and installed at the Nevada Test Site by PNL and HEDL

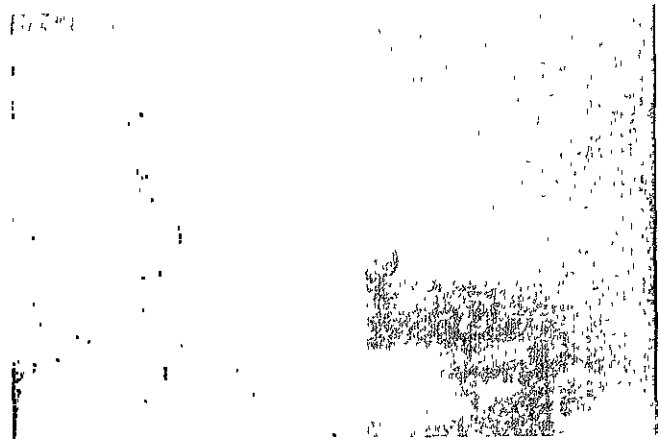
Results from initial elevated temperature whole rod tests show that significant stress relaxation occurs and stress rupture mechanisms can no longer be considered a primary mode for in-repository spent fuel breach.

EXPECTED NEAR-TERM ACCOMPLISHMENTS

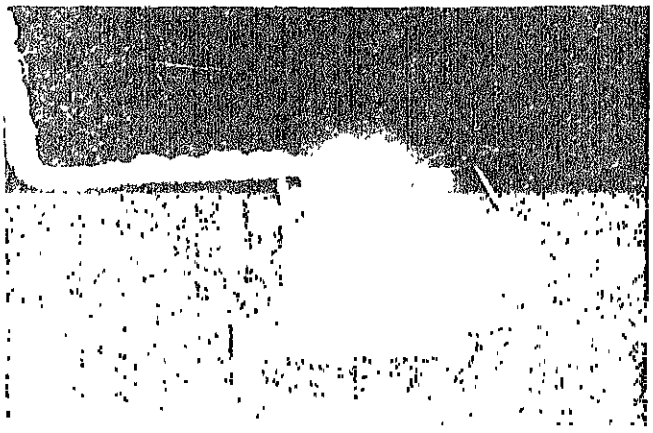
The Spent Fuel Engineering program at HEDL was redirected in FY-1981 to evaluate fuel waste form degradation mechanisms which affect long term resistance to release of radionuclides. This work will identify physical and chemical properties of spent fuel, theoretical and empirical correlations to bound degradation mechanisms and experimental work to provide information where a data base is lacking.

LITHIUM FIRE EXTINGUISHMENT

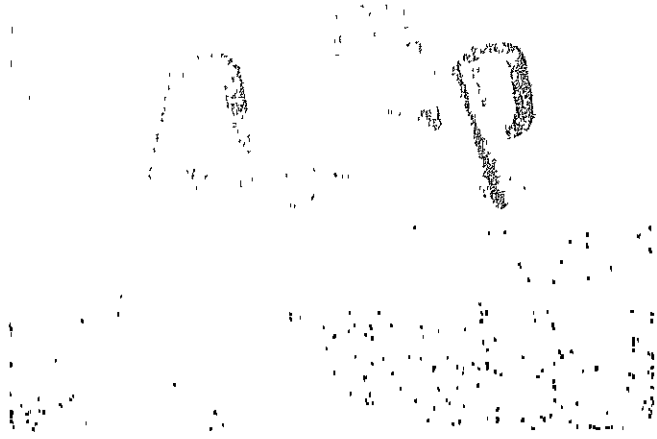
CARBON MICROSPHERES BY SPREADER



CARBONATE BASE POWDER BY SPREADER



CARBON MICROSPHERES BY SPRAYER



CARBON MICROSPHERES BY PRE-ADD

HEDL
Cost Account - ECB
Oper. X **Inv.**

FUSION REACTOR SAFETY SUPPORT STUDIES

Manager: L.D Muhlestein
Sub-Department: Technology

FY-81: $ 441K

Customer:
Organization: DOE/OFE
Contact:
Program: Special Request

OBJECTIVE

Provide experimental data regarding the use of liquid lithium and alternative breeding and coolant materials in fusion reactors, and maintain research facilities to support safety analysis and design

SCOPE

Complete lithium reaction scoping studies to include lithium-atmosphere, concrete and insulating material reactions.

Develop and proof test lithium-reaction extinguishment and control techniques.

Determine lithium reaction aerosol behavior and develop and proof test effluent control concepts.

Complete alternate coolant/blanket materials interaction scoping studies.

RECENT TECHNICAL HIGHLIGHTS

Completed lithium reaction scoping studies investigating reactions of lithium with various gaseous atmospheres, various types of concretes, and various insulating materials.

EXPECTED NEAR-TERM ACCOMPLISHMENTS

Complete tests to guide computer code development and experimentally demonstrate that temperatures and pressures which may result from lithium spray or pool reactions can be adequately predicted.

Complete scoping studies of alternative coolant and breeding materials to determine interactions and compatability under postulated accident conditions.

☆ U S GOVERNMENT PRINTING OFFICE 1981—796 848/82 REGION 10